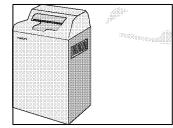




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PCR USIT 1.5L1

RIS Interface Specification

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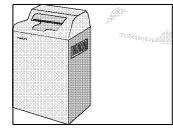
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PCR USIT 1.5L1

RIS Interface Specification

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issued by: Philips Medical Systems
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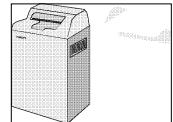
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product manager: Jürgen Schmidt _____ / _____



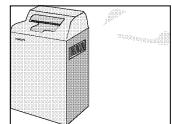
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RIS Interface Specification

PCR USIT 1.5

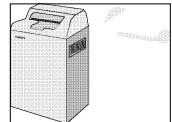
RAD-D-956/00



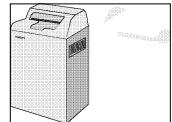
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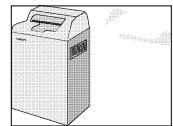
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0.2 Document History

0.2.1 Table of Updates

Version	Changes	name	date	status
0.1	Creation based on <i>PCR 5.2 RIS-Interface Specification</i> (FM-XXD-742/96).	Uwe Vigenschow		
0.2	First comments incorporated.	Uwe Vigenschow		
0.3	comments incorporated, output file delete mechanism added.	Uwe Vigenschow		
0.4	Proposal, description of the RIS Input and Output elements improved, table with valid Procedure Code characters added, minor changes.	Uwe Vigenschow		
0.5	Proposal, DBM security Output File Clean Up added, minor changes.	Uwe Vigenschow		
1.0	authorised version (RAD-D-81/97)	Uwe Vigenschow	27.11.97	Authorized
1.1	Proposal, changes due to new RIS functionality in USIT1.4: Only two mandatory keywords, new handling of bad RIS files	Oliver Schwartz		Proposal
1.2	Proposal, added description of RIS_TEST.EXE in chapter <i>Configuration Tools</i> .	Oliver Schwartz		Proposal
1.3	Comments incorporated. Authorised version.	Oliver Schwartz	16.10.98	Authorized
1.4	Converted to Microsoft Word, Changed length of PatientID and PatientLocation to 64 characters	Oliver Schwartz	05.10.00	Proposal
1.5	Review comments incorporated (allow space and '#' in procedure codes, description of new saa_proc program, spelling mistakes)	Oliver Schwartz	17.10.00	Proposal
1.6	Authorized version, corrected page numbering, Document number RAD-D-965/00	Oliver Schwartz	20.12.00	Authorized



1. Introduction

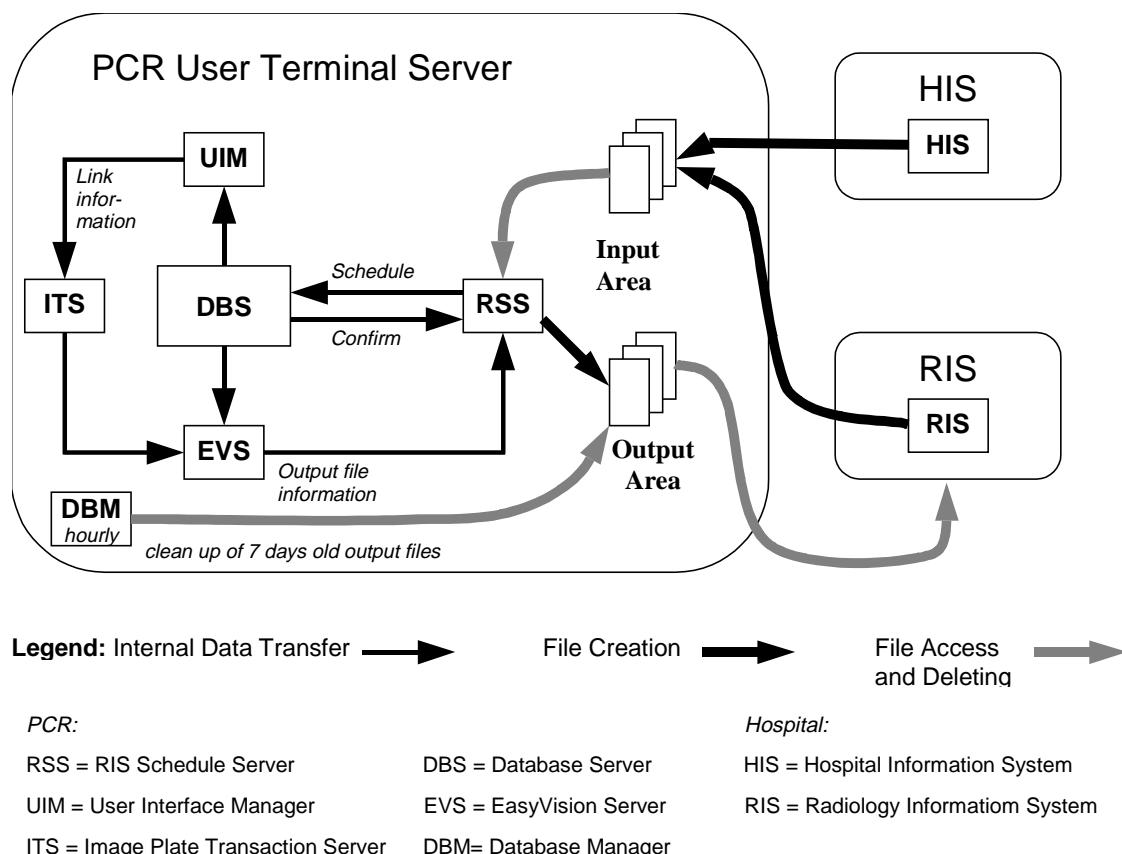
The PCR User Terminal links demographic patient and examination information to image data. This patient information can be entered manually via the terminal keyboard or via a Hospital or Radiology Information System (HIS/RIS) network. This document specifies the *PCR User Terminal-RIS bidirectional interface* for entering demographic patient and examination information into the PCR database for PCR 5.3 and returning the patient-view link information to the RIS system.

This bidirectional interface is based on network ASCII file transfer, which is usually provided by NFS or FTP, but any ASCII file transfer will work that enables reading, writing, and deleting of files.

If the RIS finds a data record scheduled for PCR, it creates a file in a fixed interface directory of the PCR User Terminal system. **The RIS guarantees that interface files are only created for CR-scheduled data.** This ASCII file keeps the relevant patient information for the PCR User Terminal. Such an input file contains information for only one patient and up to 16 PCR *Procedure Codes*. A PCR Procedure Code implicitly defines one or more examinations. The PCR User Terminal has access to the interface directory and looks for such files at fixed, short intervals. After the terminal finds a file, it will be read immediately. If no error occurs the data will be converted and added to the terminal database. In any case, the original file will be deleted after being read which implicitly needs write access to the input area directory.

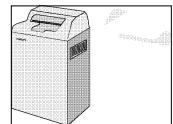
When a link is done on the PCR User Terminal 5.3 between patient-view information and a given plate and this plate is scanned in the CR reader, an ASCII output file will be created to be used by the RIS for its internal billing functionality or similar needs. The RIS reads and deletes these files.

Figure 1.1: PCR User Terminal-RIS Interface





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Though the real power of the interface is utilized by input interface files containing patient demo-graphic data and examination schedule information, this interface can also be used for simply entering patient data into the PCR database. This mode (see Section 2.3.4: *Patient Data Exchange Mode*) is useful if a hospital provides, instead of a RIS, a simpler Hospital Information System (HIS).

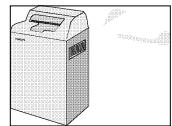
The PCR User Terminal RIS-Schedule-Server is configurable for various RIS or HIS environments.

1.1 Definitions and Acronyms

<i>ASCII</i>	American Standard Code of Information Interchange
<i>CR</i>	Computed Radiography
<i>DBS</i>	PCR User Terminal Database Server
<i>DRR</i>	Philips Dynamic Range Reconstruction Processing
<i>DICOM</i>	Digital Imaging and Communication in Medicine
<i>EV</i>	EasyVision Rad 2.3
<i>EVS</i>	PCR User Terminal EasyVision Server
<i>FTP</i>	File Transfer Protocol
<i>HIS</i>	Hospital Information System
<i>HL7</i>	Health Industry Level 7
<i>IPC</i>	PCR User Terminal Interprocess Communication
<i>ISO</i>	International Standards Organization
<i>ITS</i>	PCR User Terminal Image Plate Transaction Server
<i>MCP</i>	PCR User Terminal Master Control Program
<i>MRM</i>	FUJI Method Region Menu Code, a four digit hexadecimal number
<i>NFS</i>	Network File System, which allows transparent file access over the network
<i>OS/2</i>	IBM PC Operating System/2 Warp 3 Connect
<i>PACS</i>	Picture Archiving and Communication System
<i>PCR</i>	Philips Computed Radiography
<i>RIS</i>	Radiology Information System
<i>RSS</i>	PCR User Terminal RIS Schedule Server
<i>SNMP</i>	Simple Network Management Protocol
<i>TCP/IP</i>	Transmission Control Protocol/Internet Protocol
<i>UID</i>	DICOM Unique Identifier
<i>UIM</i>	PCR User Terminal User Interface Manager



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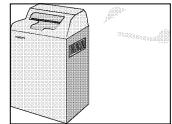
1.2 Applicable Documents

DICOM Version 3.0: ACR/NEMA Standards Publication No. PS 3.1 ff

OS/2 Warp Connect: *Up and Running!* (IBM Installation Manual)

OS/2 Warp Connect: *User's Guide to IBM Transmission Control Protocol/Internet Protocol Version 2 for OS/2: (IBM User's Manual) Installation and Administration* (SC31-6075-04)

Peer for OS/2: *Technical Reference* (S25H-7836-00)



2. ASCII File Interface

Plain ASCII files are used as an interface between RIS and PCR User Terminal. The RIS input files are located in a directory of the terminal OS/2 system named `c:\data\ris\input` by default and the RIS output files in a directory named `c:\data\ris\output`, which are shared with the RIS System¹. The file access usually is achieved via NFS or FTP, but any other ASCII file transfer is also possible. The default drive is C:, but any other existing disk drive is possible.

The RIS-created input ASCII file contains certain entries, some mandatory and others optional. The terminal RSS reads these files and checks the entries for correctness and completeness. If RSS detects an unknown entry, the entry will be ignored. If a mandatory entry is missing, the file will be ignored.

If a mandatory entry is missing or any entry exceeds its length limit, RSS generates a PCR User Terminal error message via MCP in the logfile and ignores the file. The maximum number of these error messages in the logfile is limited in order to keep error log files down to a usable size. If the number of error messages exceeds this configurable limit (default: 20), any further error indication will be suppressed (see Section 3.1 for details). If a file open fails, RSS assumes the file is still opened by the creating application (RIS or HIS) and tries to read the next file. If a file is successfully imported it is deleted, otherwise it is moved to the error directory (usually `c:\data\ris\error`). The number of files archived in the error directory is limited to the number of error messages. If the number of files exceeds its limit, the oldest files are deleted.

The RSS created output ASCII file contains the patient id, number of film copies, film format, examination and view information as well as date and time of the link between this information and a specific plate in the same format as the RIS created input file. If a Procedure Code and/or an Accession Number were used for the scheduling, they will also be found in the output file. According to the configuration, output files will be created either for all linked plates or only for plates linked to RIS-scheduled examinations (which is the default).

2.1 ASCII File Transfer

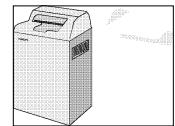
The RIS File Interface is based on ASCII file transfer via network. Usually one or more specific transfer methods are preferred in a hospital RIS or HIS system. The PCR User Terminal already provides a few of these interfaces. The operating system of the PCR User Terminal is IBM's OS/2 Warp Connect including NFS. NFS is based on TCP/IP which includes FTP. SNMP and IBM Peer are also supported. Using one of these should result only in configuration work on the PCR User Terminal's side of the world.

2.2 Bidirectional RIS Interface File Format

A RIS interface input file must be placed by default on the PCR User Terminal system in the directory `c:\data\ris\input`, an output file in `c:\data\ris\output`. They are ASCII files using the **ISO-IR 100 (Latin 1) or the multilingual PC (850) character set**. An input file contains scheduled demographic patient data for a certain study to be inserted in the terminal database via the terminal DBS. An output file consists of patient id and link information for a certain plate. The ISO Latin 1 character set will be translated to the PC character set by the RSS program and vice versa. The character set used for both files must be entered in the RSS configuration, which has **ISO-IR 100 (Latin) as default**.

The RIS has an unrestricted choice of file names as long as unique file names are created for the interface files. The PCR User Terminal OS/2 PC uses HPFS as the file system, so file names longer than 8 characters

¹ **Restriction:** The RIS interface runs only on single terminals or on main server terminals but not on clients.



can be used. However, the ASCII file transfer method may be more restrictive. Thus, file names with a maximum of 8 characters + a period + a maximum of 3 characters (DOS convention) are recommended. **The max. length of a file name is 64 characters.**

The data consists of specific entries. An entry can be mandatory or optional. Each entry is placed in a line by itself terminated with an End-of-Line (EoL). The choice of the EoL character(s) between CR = ASCII 13₁₀ , LF = ASCII 10₁₀ or CRLF is unrestricted and an optional End-of-File character (Ctrl-Z = ASCII 26₁₀) can be used by the RIS. The RIS Interface Output file uses LF = ASCII 10₁₀ as EoL character for ISO-IR 100 coded files and CRLF for multilingual PC-coded files.

The order of the entries is unrestricted as long as all mandatory entries are found. Each entry, with the exception of the Procedure Code in Input files, is used only once in a file. If the same entry is found twice, the older value will be overwritten and the new value will be used. However, a RIS Interface Input file can contain up to 16 Procedure Code entries. RSS will schedule the first 16 procedures. Any further Procedure Codes will be ignored.

To prevent incorrect duplication of information between RIS and PCR, RIS Input files are ignored if any entry (mandatory and optional) exceeds its limit.

Each line consists of a keyword and an entry. The entry can be encapsulated between start and stop delimiters (see Section 3: *Configuration*).

KEYWORD<white space><start delimiter>ENTRY<stop delimiter><EoL>

e.g.: PATIENT_NAME <Doe>

if the keyword is defined as PATIENT_NAME, the last name of the patient is Doe and < and > are used as delimiters. The parts of such a line are defined as follows:

KEYWORD	string restricted to upper- and lowercase characters (ASCII 65 ₁₀ - 90 ₁₀ and ASCII 97 ₁₀ - 122 ₁₀), numbers (ASCII 48 ₁₀ - 57 ₁₀) and the underscore (ASCII 95 ₁₀). The maximum keyword length is 20 characters.
ENTRY	string without control characters (ASCII < 32 ₁₀). If no delimiters are used, leading blanks are not read. If delimiters are used the characters of the delimiter strings cannot be used in the entry.
<white space>	at least one blank (ASCII 32 ₁₀) or horizontal tabulator (ASCII 9 ₁₀). The <white space> is optional if <start delimiter> and <stop delimiter> are used.
<start delimiter>,	
<stop delimiter>	unique string of at least one and max. eight characters , that cannot be used in the keywords or entries. The use of delimiters is optional. If they are not used, leading blanks cannot be included in an entry.
<EoL>	CR, LF or CRLF are possible (CR = ASCII 13 ₁₀ , LF = ASCII 10 ₁₀).

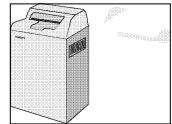
The maximum length of each line including the EoL character(s) is **255 bytes**, but the length used for each entry line depends on the maximum length for keywords, delimiters, and End-of-Line characters, and the maximum possible length of the entry, which is entry-dependent and defined later in this document.

2.2.1 Parsing Algorithm

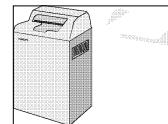
The parsing of each line follows these rules in the given order to determine the kind of the entry defined by the keyword and the entry itself. In general, these rules are identical for RIS Input and Output files. Differences are marked explicitly.



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1. Look for the first non-blank character in the line. This is the first character of the keyword. The keyword ends at the character before the next white space or start delimiter. Extract the keyword string.
2. a) *for input files:*
Look for the keyword in the PCR User Terminal translation table (see Section 2.5: *RIS-PCR User Terminal Translation Table* and Section 3: *Configuration*). If the keyword is not found, stop parsing and ignore the line. If the keyword is found, read the PCR User Terminal field name from the table.
b) *for output files:*
Look for the keyword in the RIS/HIS internal translation table. If the keyword is not found, stop parsing and ignore the line. If the keyword is found, use the RIS internal field name from that table.
3. If delimiters are used, scan the line for the start delimiter. The entry starts directly after the delimiter. If no delimiters are used, the entry starts at the first non-blank character after the keyword and the white space.
4. The entry ends at the last character before the stop delimiter or immediately before the EoL character(s). Extract the entry string.
a) *for input files:*
Using the format definitions (see Section 3.2: *RIS Configuration*), the entries are transformed into PCR internal formats. If format errors occur, the line will be ignored. If the entry exceeds its maximum entry length the file will be ignored.
b) *for output files:*
The format of the values is fixed for each entry. The entries must be changed into RIS/HIS internal formats. If the examination and view name are used by the RIS/HIS, the definition in the PCR User Terminal anatomy database must be known to the RIS/HIS. If the film format information is needed, the interpretation of the film format string must be based on the definition of the film formats on the EV as selectable from the PCR User Terminal (see Section 2.4.2: *Examination, View, and Film Format Names*).
5. Empty lines are ignored.



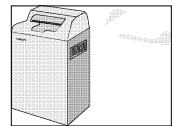
2.2.2 RIS Input Interface Elements

A RIS Input Interface element can be mandatory or optional. Mandatory elements must always be sent and their values must not be empty. However, the mandatory elements carrying the *Accession Number* and the *Patient Date of Birth* can use the string *NONE* if their RIS entries currently have no values. The mandatory patient name must be passed either as *Patient Last Name* or as *Patient Name in DICOM Name Format*.

RSS Descriptor	Description	Sent	Max. Entry Length
PATIENT_ID	unique patient identifier	always	64 characters ^{1), 2)}
PATIENT_LAST_NAME or PATIENT_DICOM_NAME	last name of patient or patient name in DICOM format	always ²⁾	24 characters ⁴⁾ or 64 characters ^{4), 5), 6)}
PROCEDURE_CODE	examination procedure code	always ⁷⁾	20 characters ^{10), 11)}
ACCESSION_NUMBER	RIS accession number (DICOM)	opt. ^{8), 13)}	16 characters ⁶⁾
PATIENT_BIRTHDAY	date of birth of patient	opt. ^{8), 13)}	10 characters ⁶⁾
PATIENT_GENDER	sex of patient	opt. ¹³⁾	1 character ^{6), 9)}
PATIENT_FORE_NAME	first name of patient	opt.	19 characters ⁴⁾
PATIENT_MIDDLE_NAME	middle name of patient	opt.	19 characters ⁴⁾
STUDY_UNIQUE_ID	unique study identifier (DICOM)	opt. ⁸⁾	64 characters ⁶⁾
EXAM_TIME	scheduled time of examination	opt. ¹²⁾	8 characters ⁶⁾
EXAM_DATE	scheduled date of examination	opt. ¹²⁾	10 characters ⁶⁾
STUDY_LOCATION	location of study	opt.	16 characters
PATIENT_LOCATION	location of the patient	opt.	64 characters ¹⁴⁾
PHYSICIAN	referring physician	opt.	64 characters ⁶⁾
DIAGNOSIS	admitting diagnosis	opt.	64 characters ⁶⁾

Table 2.1: RIS PCR User Terminal Input Interface Elements

- 1) limited to characters from a-z, A-Z, 0-9, the characters + - . / and _ (ASCII 43₁₀, 45₁₀, 46₁₀, 47₁₀, and 95₁₀), and accented characters.
- 2) extended from 15 to 64 characters in USIT release 1.5.
- 3) for alternative use, the patient name can be entered using PATIENT_LAST_NAME (and opt. FORE and MIDDLE name) or PATIENT_DICOM_NAME in DICOM format, where prefix and suffix will be ignored. If both entries are found in a file, PATIENT_DICOM_NAME will be ignored.
- 4) the DICOM size for the complete patient name (tag 0010,0010) is 64 characters. For this interface the name is separated, and prefix and suffix are not supported.
- 5) each part of the DICOM name must fit within the limits for last name (24), fore (19), and middle name (19). The DICOM name format is defined as lastname^firstname^middlename^prefix^suffix .
- 6) entry according to related DICOM tag possible.
- 7) not mandatory in Patient Data Exchange mode (see Section 2.2.5).
- 8) if the RIS cannot provide an entry, the RIS interface needs the indicator string *NONE* (see Section 2.2.3).
- 9) the input is restricted to the DICOM values M=male, F=female, and O=other.
- 10) up to 16 Procedure Codes are allowed per input interface file, the other elements are used only once per file.
- 11) for the valid characters see Section 2.2.5: *PCR Procedure Code*.
- 12) if one or both elements are missing the current date and/or time are used.
- 13) keyword is mandatory for USIT release 1.3 and prior versions.
- 14) extended from 16 to 64 characters in USIT release 1.5.



Optional elements need not to be sent, and if they are sent, their values can be empty. However, the optional element carrying the *Unique Study Identifier* STUDY_UNIQUE_ID must use the value NONE if it is present and its RIS entry currently has no value.

Each element is described by a fixed RSS internal descriptor and a configurable RIS keyword. The interface elements for RIS input files are defined in Table 2.1. Optional elements are marked by a gray layer. The RIS keywords are defined in a RIS-PCR translation table described in Section 2.5: *RIS-PCR User Terminal Translation Table*.

Note that the number of mandatory elements has changed with USIT release 1.4. Also note that the length of PATIENT_ID and PATIENT_LOCATION was extended from 16 to 64 characters in USIT release 1.5.

If any of the mandatory entries is missing in a RIS input interface file, the file is ignored. In this case, RSS generates an error message in the logfile using MCP, if the limit of logfile errors has not been reached. Otherwise, error indications are suppressed. The file is moved to the error directory (usually c:\data\ris\error).

The *Max. Entry Length* is the maximum entry length. For optional interface elements, the entry can be blank, but mandatory elements need a non-blank string as an entry. The minimum length for non-date or -time entries is one character. The format of date and time is configurable (see Section 3: *Configuration*). The date and time strings must fit the configured date and time format.

Except for the Procedure Code in RIS input files, each element is used only once per file. If an element is found twice the element entry, found later will be used and the former elements will be overwritten internally. For the Procedure Code in RIS input files up to 16 entry lines are allowed per file. If more entries are found the first 16 entries will be used and later elements will be ignored.

2.2.3 RIS Output Interface Elements

A RIS output file contains 11 elements that are always provided plus up to 10 additional elements that will be provided only if their entries exist (see Table 2.2)

As with the input interface elements, the *Max.Entry Length* is the maximum length of a value except for EXAM_DATE, EXAM_TIME, PATIENT_BIRTHDAY, and RIS_SOURCED which have a fixed entry length. The date format is fixed to

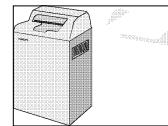
YYYYMMDD
with YYYY as four digit year (e.g.: 1997),
MM as two digit month from 01 to 12, and
DD as two digit day of the month from 01 to 31.

and the time format to

HHMMSS
with HH as two digit hour from 01 to 23,
MM as two digit minutes from 00 to 59, and
SS as two digit seconds from 00 to 59.

Valid entries are for example: 19970320 for the date and 160357 for the time entry to define the date and time of 4 PM 3 minutes and 57 seconds on March 20, 1997.

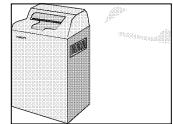
If any of the mandatory elements is missing the RIS must ignore the file. The optional entries are given only if their values exist, which means that they have either been passed in from the RIS or entered by the user on the PCR User Terminal. Otherwise these entries are missing. Except for 8 new output interface elements, the interface elements are the same as those used for the Input file.



RSS Descriptor	Description	Sent	Max. Entry Length
PATIENT_ID	unique patient identifier	always	64 characters ^{1), 2), 15)}
EXAM_DATE	scheduled date of examination	always	8 characters ^{1), 3), 4), 5)}
EXAM_TIME	scheduled time of examination	always	6 characters ^{1), 3), 4), 5)}
EXAM_NAME	name of the examination	always	15 characters ^{6), 7)}
VIEW_NAME	name of the view	always	15 characters ^{6), 7)}
FILM_LAYOUT	film layout format name used	always	16 characters ^{6), 7)}
LAYOUT_POSITION	no. of the position of the image on a composite film format	always	2 characters ^{6), 7), 8)}
FILM_COPIES	no. of film copies	always	2 characters ^{3), 6), 7)}
IMAGE_SEQUENCE	sequence index of image	always	2 characters ^{6), 7)}
DEFAULT_IMAGE_COUNT	def. no. of images for the exam.	always	2 characters ^{6), 7)}
RIS_SOURCED	1 if examination was scheduled by the RIS, 0 otherwise	always	1 character ⁶⁾
ACCESSION_NUMBER	RIS accession number (DICOM)	if exists	16 characters ^{1), 4), 10)}
PROCEDURE_CODE	examination procedure code	if exists	20 characters ^{1), 10), 11), 12)}
PATIENT_DICOM_NAME	patient name in DICOM format	if exists	64 characters ^{1), 13)}
PATIENT_BIRTHDAY	date of birth of patient	if exists	8 characters ^{1), 6)}
PATIENT_GENDER	sex of patient	if exists	1 character ^{1), 14)}
STUDY_UNIQUE_ID	unique study identifier (DICOM)	if exists	64 characters ¹⁾
STUDY_LOCATION	location of study	if exists	16 characters ¹⁾
PATIENT_LOCATION	location of the patient	if exists	64 characters ^{1), 16)}
PHYSICIAN	referring physician	if exists	64 characters ¹⁾
DIAGNOSIS	admitting diagnosis	if exists	64 characters ¹⁾

Table 2.2: PCR User Terminal Output Interface Elements

- 1) used also as input interface element.
- 2) limited to characters from a-z, A-Z, 0-9, the characters + - . / and _ (ASCII 43₁₀, 45₁₀, 46₁₀, 47₁₀, and 95₁₀), and accented characters.
- 3) entry according to related DICOM tag possible.
- 4) date and time where a certain plate is linked to the examination data on the PCR User Terminal.
- 5) the date and time formats are fixed and described above.
- 6) new output interface element.
- 7) these values can be used to determine the number of images and the number of films and film copies.
- 8) valid position no. are: 0 or 1 for no composite format, 1-99 for positions beginning from top left to top right row.
- 9) an Accession Number will be found in the output file only if it is not empty on the PCR User Terminal
- 10) a Procedure Code will be found in the output file only if the patient was scheduled by Procedure Code.
- 11) only one Procedure Codes is allowed per output interface file as for the other output file elements.
- 12) for the valid characters see Section 2.2.5: PCR Procedure Code.
- 13) see remarks 4) and 5) of Table 2.1: RIS PCR User Terminal Input Interface Elements.
- 14) as with the input, the output is restricted to the DICOM values M=male, F=female, and O=other.
- 15) extended from 15 to 64 characters in USIT release 1.5.
- 16) extended from 16 to 64 characters in USIT release 1.5.



2.2.4 Accession Number, Study Instance UID and Patient Birthdate

The Accession Number is a DICOM tag (0008,0050) that is defined as a *RIS generated number that identifies the order for the study* (in contrast to the Study ID, which is merely a user- or equipment-generated study identifier). Note that the Accession number was mandatory in USIT releases prior to 1.4. It is treated as an optional attribute in release 1.4 and later versions. In contrast to the DICOM standard, no empty values are allowed for the Accession Number in the RIS Interface file. If a RIS does not support Accession Numbers the RIS Input Interface files must be created with the Accession Number entry NONE as in

```
ACCESSION_NUMBER <NONE>
```

A missing Accession Number can be entered at the PCR User Terminal. For the RIS Output Interface files, the Accession Number entry is written only when the Accession Number exists.

The Patient Date of Birth, which can be configured to the format of the DICOM tag (0010,0030), is handled in a similar way. If the birthday is unknown to the RIS the RIS Interface file must be created with the Patient Birthday entry NONE as in

```
BIRTHDAY <NONE>
```

The Date of Birth for a patient scheduled from the RIS cannot be changed on the PCR User Terminal. The mandatory DICOM tag Study Instance UID (0020,000D) is handled in the same way, but this entry is optional for the RIS interface. This tag is used as *unique study identifier* by the RIS and linked to the RIS interface element STUDY_UNIQUE_ID. If the RIS cannot provide a Study Instance UID an empty value must be indicated in the RIS interface file by the string NONE as in

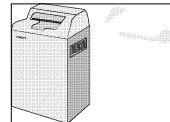
```
STUDY_UNIQUE_ID <NONE>
```

If the RIS does not supply a Study Instance UID, as in the example above, the EV will generate a UID. For the RIS Output Interface files, the Study Unique ID entry is written only when the Study Unique ID exists. **If the Study Instance UID is given but exceeds the limit of 64 characters, the RIS interface file will be discarded to avoid different Study Instance UIDs on RIS and PCR.**

2.2.5 PCR Procedure Code

The PCR Procedure Code defines a complete procedure consisting of one or more examinations from the PCR User Terminal anatomy database. It serves as a unique identifier for a procedure used by the RIS system to schedule examinations. The Procedure Code will be defined by the RIS vendors or the hospital. To handle all different Procedure Codes the PCR User Terminal-RIS interface handles them as a **string of max. 20 characters** (In a DICOM environment the Procedure Code length is limited to 16 characters.). Each procedure code may define up to **15 exams**. Each exam must have at least one routine view and no more than 8 routine views. The hospital-wide definition of the Procedure Code must be consistent for the creation of the interface files by the RIS and for the PCR User Terminal or EV to interpret the codes. The PCR User Terminal manages its Procedure Code reference in a Procedure Code database. Using this Procedure Code database, the RIS-defined Procedure Codes are linked with PCR internal Procedure Codes, which can be handled by the PCR User Terminal.

The Procedure Code is an alpha-numeric string without blanks (ASCII > 32₁₀) limited to the characters shown in Table 2.3. The special characters of the DICOM or HL7 delimiter set (& = ASCII 38₁₀, \ = ASCII 92₁₀, ^ = ASCII 94₁₀, | = ASCII 124₁₀, and ~ = ASCII 126₁₀) are excluded from the list of valid characters. **During the installation the service personnel must make sure that no possible character of the Procedure Code is used in the delimiter strings if delimiters are used and that all examinations**



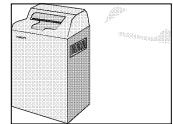
considered by RIS to belong to a Procedure Code are actually present in the terminal anatomy database. If they are missing they must be added.

ASCII Code ¹⁾ (dec.)	Represen-tation	ASCII Code (dec.)	Represen-tation	ASCII Code (dec.)	Represen-tation	ASCII Code (dec.)	Represen-tation
32	" "	128	Ç	149	ò	211	Ë
35	#	129	ü	150	û	212	È
37	%	130	é	151	ù	214	Í
40	(131	â	153	Ö	215	Î
41)	132	ä	154	Ü	216	Ï
42	*	133	à	155	ø	222	Ì
43	+	134	å	157	Ø	224	Ó
44	,	135	ç	160	á	225	ß
45	-	136	ê	161	í	226	Ô
46	.	137	ë	162	ó	227	Ò
47	/	138	è	163	ú	228	õ
48-57	0-9	139	ï	164	ñ	229	Õ
58	:	140	î	165	Ñ	231	þ
59	;	141	ì	181	Á	232	Þ
60	<	142	Ä	182	Â	233	Ú
61	=	143	Å	183	À	234	Û
62	>	144	É	198	Ã	235	Ù
65-90	A-Z	145	æ	199	Ã	236	Ý
95	-	146	Æ	208	ð	237	Ý
96	'	147	ô	209	Đ		
97-122	a-z	148	ö	210	Ê		

Table 2.3: Valid Procedure Code Characters

1) the ASCII code > 127 is based on PC Codepage 850 (Multilingual)

This general approach with the above specified limitations should enable the PCR User Terminal RIS Schedule Server to handle all ASCII-based Procedure Codes. The Procedure Code may be a single code word or may contain a substructure such as the RADOS procedure codes, which combine a general abbreviation with a location (left, right,...) separated by a fixed character. As long as the Procedure Code fits within a 20 character string, the PCR should be able to use the code. In any case, the use of the Procedure Codes must be consistent between the PCR and the RIS/HIS system.



2.3 RIS Interface Input File Handling

2.3.1 File Checking Cycle

RSS looks for the RIS interface files at fixed, configurable intervals. When the file checking starts RSS looks for the first file in the input directory and tries to open it. If RSS cannot open the file, it will be ignored but not deleted, and RSS will look for the next interface file in the directory.

If the file open is successful, RSS reads the file as described in Section 2.2.1: *Parsing Algorithm*. If a specific End-of-File string is defined (see Section 2.3.2: *File Opening* and Section 3: *Configuration*) RSS checks for the existence of this keyword. If it does not exist, RSS assumes that the file is not yet completed by the RIS and closes the file without deleting it. If the file was successfully imported it will be deleted by RSS after being read. Otherwise it will be moved to the error directory. The number of files archived in the error directory is limited to the number of error messages that can be configured via RIS_CFG. If more than the maximum number of files are found in the error directory the oldest files will be deleted.

If RSS does not find any more interface files, it exits the file-checking cycle and waits for the configurable delay time before starting the file checking again.

2.3.2 File Opening

To make sure that an interface file has been written completely by the RIS two security mechanisms are supported by the RSS program. They can be used separately or in combination. The RSS program always opens an interface file for exclusive reading and writing so that it can delete the file after reading it.

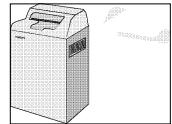
- The RIS also opens the new interface file for exclusive reading and writing. Thus RSS generates a file open error if it tries to open the file during creation by the RIS. In that case RSS ignores this interface file.
- A specific End-of-File string can be defined in the RSS configuration. The RIS uses this End-of-File string as a keyword without any additional entry for the last line of information in the interface file. If RSS cannot find this End-of-File string as the keyword the interface file will be ignored.

Both mechanisms result in ignoring the interface file without deleting it, so that the interface file can be read after its completion in one of the next file-checking cycles.

2.3.3 PCR User Terminal Database Update

If RSS finds a correct interface file the patient and examination information of the interface file is added to the database. If the *PatientDataExchange mode* (see Section 2.3.4: *Patient Data Exchange Mode*) is active and no examination information is found in the interface file, the patient data are added to the patient database. However, if the *Patient Data Exchange* mode is not active, and no examination information is found, the patient data are not added.

If an ID already exists but is assigned to a different patient name, RSS tries to update the entry in the database by changing the name. If no examination is in progress the update will be performed. Otherwise the file will be ignored until the examination is completed. Then a new schedule examination entry will be created. RSS accepts multiple entries for one patient and gives no warning about multiple entries, even if the same examination already exists for a certain patient. It simply schedules multiple instances of the examination.



If examination information is found the *Procedure Code* will be checked before the database is changed. RSS makes sure that the Procedure Code used in the interface file is known to the PCR User Terminal database as a valid code. If the Procedure Code is invalid, the interface file will be ignored and moved to the error directory, the database will not be modified, and an error message will be logged in the logfile via MCP, if the maximum number of errors has not been reached. Otherwise, any error indication will be suppressed. Finally, RSS searches for the next interface file. The RSS program will not violate PCR User Terminal limits. It is possible to schedule up to 16 examinations per patient. The RIS should not schedule more than this limit of examinations per patient by *Procedure Code*. Additional examinations above that limit will be ignored.

2.3.4 Patient Data Exchange Mode

Usually RSS schedules examinations for a specific patient. If RSS is configured for Patient Data Exchange (see Section 3: *Configuration*) this is also possible, but in addition, patient data without any scheduling data can be entered into the patient database of the PCR 5.3 User Interface Terminal as described in Section 2.3.3. This feature can be used by a HIS that only has access to patient data not to examination information. The scheduling of the examination for these patients must be done interactively using the PCR 5.3 User Interface Terminal. **If this mode is active the Procedure Code and the Accession Number are no longer mandatory. Any supplied Accession Number will be ignored if no Procedure Code is supplied.**

If the Patient Data Exchange mode is active the HIS must make especially sure that data files only meant for the PCR system are entered into the interface directory. Otherwise, unused patient data will fill up the terminal patient database. There is no automatic selection mechanism implemented in the current version of RSS (future releases may have a HIS-Data-Selection based on certain entries as e.g.: Patient Location or Study Location).

2.4 RIS Output Interface File Handling

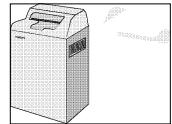
The RIS output file is created from the RSS program immediately after a link between patient and view data with a specific plate in the image plate reader. The RIS must look for these files periodically. The files are created in the RIS output directory. By default this directory is on the harddisk of the PCR User Interface Terminal, but it can be reconfigured for any accessible drive and directory, e.g., for a NFS-mounted drive on a computer of the RIS system. Changing to a mounted drive needs a reconfiguration of the PCR User Interface Terminals OS/2 TCP/IP configuration (see Section 3.8: *OS/2 TCP/IP Configuration*).

After the RIS has read and interpreted the output file, the file must be deleted by the RIS whether or not it has been successfully interpreted. Therefore, the RIS must open the file with read and write access. If the open fails because the RSS is still writing the file, the RIS must retry the file open later. During the file creation, the RSS keeps the file continuously open all the time. This mechanism ensures that the RIS does not try to interpret and delete a file during the creation process.

Usually the RIS needs the data immediately after its creation but at least on the same day. Therefore the RIS must poll for the RIS Output files in short intervals. For security reasons, **the PCR User Terminal program DBM.EXE deletes all RIS Output files older than seven days** not to keep unused data. DBM.EXE uses the *Last Access date and time* of the RIS Output files to determine if files must be deleted.

2.4.1 File Name Convention

The output file names must be unique in order not to overwrite existing files. The file names are created using the current time on the PCR User Terminal following the UNIX conventions. Following that convention, the time is given in seconds, starting at January 1, 1970. In 1997, these numbers consist of 9



digits, e.g. 858889972 for March 20, 1997 3:32 PM. For the lifetime of this UNIX convention until the year 2049, this number will not exceed 11 digits. The file name is created using the last three digits as the extension and the other digits as the base name. For the example above, the file name would be 858889.972 . This mechanism guarantees that the RIS output file name fulfills the DOS naming conventions.

The RSS program checks whether a file with the same name already exists. Duplicate file names may occur after daylight savings time changes. In case of a duplicate name, RSS waits for a second, gets the current time, creates a new file name, and repeats the check until a new file name is found.

2.4.2 Details of the RIS Output Interface Elements

The examination and view names used for the output file are the strings defined in the anatomy database of the PCR User Terminal. The film layout names are defined by the EasyVision Rad as film format names, but they describe the layout and not the format. If the RIS wants to use the examination, view, and film layout name information of the RIS output file, the current definitions must be known by the RIS. In the PCR system, these names have language dependent defaults and can be redefined by the user (hospital).

The layout position is the position of a certain view in the used film layout. If the layout position > 1 the current view is printed on the same film as its precursor with the position 1. If the film layout defines only one view per film the layout position can be 0 or 1. The image sequence starts with 1 for the first view and increments with each following view linked to a plate for a certain examination.

2.4.3 RIS Output Interface File Format

The RIS Output Interface File format is fixed with the exception that the delimiters can be used by default or switched off:

KEYWORD<blank><startDelimiter>ENTRY<stopDelimiter><EoL>

with <blank> a single blank (ASCII 32₁₀)

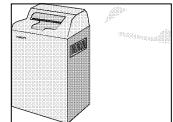
<EoL> LF for RIS_File_Char_Set=1, otherwise CRLF (see Sections 2.2 and 3.2)

2.5 RIS-PCR User Terminal Translation Table

The RIS-PCR User Terminal translation table defines

- the RIS keywords, which the RIS uses for creating the input interface file and the PCR RSS program uses for creating the output interface file and
- the mapping of these keywords to PCR User Terminal database elements. This translation table is part of the RSS configuration. For any element that RSS supports, an entry

exists in the RSS configuration file that defines the RIS keyword for the internal RSS descriptors. Each RSS descriptor is linked implicitly to a PCR User Terminal database element, so that any supported RIS keyword corresponds to a terminal database entry (see Sections 2.2.2: *RIS Input Interface Elements* and 2.2.3: *RIS Output Interface Elements*).



3. Configuration

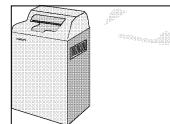
To support various RIS environments, the RIS-PCR User Terminal interface is configurable. The RSS is an OS/2 program and uses the OS/2 binary configuration file approach. Such a configuration file consists of at least one group and each group contains at least one entry. An entry consists of a *key* and a *value*. The key is a string and the value can be either a string or an integer number. A group is identified by a name, which, like a key, is a string.

The RSS configuration file is named `RIS_CFG.INI` and placed in the current directory of the terminal (`C:\USER\USIT`). It contains four groups but only three are used by the RSS program:

- RSS: RSS program configuration,
- RIS: RIS configuration,
- TABLE: RIS-PCR User Terminal translation table,
- and
- ROUTING: not used by RSS but by other PCR 5.3 programs.

In the RSS group, the RSS internal configuration is handled (e.g., the file check interval in seconds). The RIS configuration defines the necessary RIS information for the RSS program, such as directory names. The RIS-PCR User Terminal Translation Table defines the RIS keywords of element names (see Section 2.5: *RIS-PCR User Terminal Translation Table*). The ROUTING group is of no interest for the PCR 5.3-RIS Interface.

Configuration changes need a PCR User Terminal program restart to become operative. They affect examinations scheduled thereafter, but not data that has already been scheduled.



3.1 RSS Program Configuration

The program configuration controls the execution of the RSS program. Usually, the standard values can be used. They should be changed only if necessary. The program defaults are defined in Table 3.1. The RSS configuration consists of integers only. Four entries have a general meaning and are described in this document, while the shaded one is for internal use, and is described further in the *RIS Schedule Server (RSS) Design Specification*.

Key	Default Value (Range)	Description
FileCheckInterval	30 (1-600)	Delay in seconds between two attempts of RSS to find and read RIS interface files
MaxErrorNum	20 (1-600)	Maximum number of RSS error messages, also maximum number of files in error directory
PatientDataExchange	0 (0=off, 1=on)	Enables patient data exchange mode which allows entering of patient data without scheduling information
DebugMode	0 (0=off, 1=on)	Activates stand-alone test mode
LoopTimeOut	1 (1-60)	Delay in seconds between semaphore checks. Should be less than <i>FileCheckInterval</i> (internal)

Table 3.1: RSS Configuration Defaults

If a file-checking cycle is activated, RSS tries to read and import up to 10 files found in the input directory. After the files are read or if no file is found RSS waits for *FileCheckInterval* seconds to start the next file checking. The limit of 10 files per run is used not to slow down the PCR User Terminal by permanent background activity.

MaxErrorNum is the maximum number of RSS errors logged in the logfile via MCP. If the RIS is not able to distinguish between PCR and other examinations, the RIS may create many incorrect interface files. In order not to fill the logfile with these unimportant error messages, the number of RSS errors collected is limited. The error logging starts new after each restart of the PCR Terminal. *MaxErrorNum* is also the maximum number of rejected RIS files in the error directory.

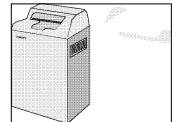
PatientDataExchange enables the patient data exchange mode. If patient data without scheduling information is found in the interface file, these patient data will be entered in the PCR 5.3 User Interface Terminal patient database, but no examinations will be scheduled. With *PatientDataExchange* disabled such a file will be ignored.

For an initial, simple test of RIS Interface files, the *DebugMode* switch can be activated. The RSS program runs independently of other PCR programs, including MCP. In this mode RSS can be started manually from an OS/2 window or OS/2 full-screen mode. First change the current directory by entering

CD \USER\USIT <Enter> and

start the RIS Interface program with

\USIT\BIN\RSS <Enter> .



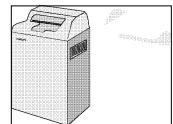
In debug mode, RSS does not add data to the PCR database but displays the found items in the RSS OS/2 window. If RSS runs in the usual PCR environment use **<Ctrl><Esc>** to open the *Window List*. Highlight the RSS program by using the cursor keys and press **<Enter>** to display the RSS window. When finished, use **<Ctrl><Esc>** to reopen the *Window List* and choose *Patient List Window* to return to the application.

RSS will display the found keywords and their values. At the end of each line a character indicates a mandatory field (m), an optional field (o), a default value of an optional field (d), or an internal field (i). Finally the maximum entry length is given in brackets. Each line starts with an internal number. Usually the numbers 12, 16 and 17 are missing. They belong to internal fields which are not used by the RIS Interface. If the keywords of the Accession Number, the Study Instance UID, or the Patient Birthday are found but marked as empty (see Section 2.2.4), the values are named empty.

```
RIS Interface File: c:\data\ris\input\ris.dat
1. PATIENT_ID : 123ABC (m) [15]
2b. PATIENT_LAST_NAME : Doe (m) [24]
3. ACCESSION_NUMBER : 1234abcd (o) [16]
4. PATIENT_BIRTHDAY : 7.10.1961 (o) [10]
5. PATIENT_GENDER : M (o) [1]
6a. PROCEDURE_CODE : Test1 (m) [20]
7. PATIENT_FORE_NAME : John (o) [19]
8. PATIENT_MIDDLE_NAME : M (o) [19]
9. EXAM_TIME : 45296 (o) [8]
10. EXAM_DATE : 835761600 (o) [10] date+time: Wed Jun 26 12:34:56 1996
11. STUDY_LOCATION : R2 D2 (o) [16]
13. PATIENT_LOCATION : C3 PO (o) [16]
14. PHYSICIAN : Frankenstein^Victor^^Dr (o) [64]
15. DIAGNOSIS : Appendicitis (o) [64]
18. STUDY_UNIQUE_ID : dcba4321 (o) [64]
```

No errors detected

If RSS generates an error an error number or error information will be displayed on the screen together with additional parameters. See Section 4: *Error Handling* for details.



3.2 RIS Configuration

The RIS configuration describes the physical access to the RIS. During the installation, the service or application engineer adjusts the RIS configuration to the RIS used, if the defaults differ from the RIS environment found. The standard values are defined in Table 3.2. For the date and time formats the DICOM format is used as default. The RIS configuration consists of strings and integer values.

Key	Default Value	Description	Length
Input_Path	c:\data\ris\input\	Drive and path for RIS interface input files of the RIS system. Uses current directory if empty.	0-64 chars.
Output_Path	c:\data\ris\output\	Drive and path for RIS interface output files for the RIS system. Uses current directory if empty.	0-64 chars.
Error_Path	c:\data\ris\error\	Drive and path for rejected RIS interface input files. A separate directory is highly recommended.	0-64 chars.
Date_Format	yyymmdd	Format of date entries in the RIS interface file. See section 4.2.1: <i>Date/Time Conversion</i> for further details.	6, 8 or 10 chars. ¹⁾
Time_Format	hhmmss	Format of time entries in the RIS interface file. See section 4.2.1: <i>Date/Time Conversion</i> for further details.	6 or 8 chars. ²⁾
RIS_EoF		If this string is not empty, it defines an additional keyword to mark the end of a RIS interface file. Ignored if empty (standard value). RSS uses this string to determine whether a file creation is terminated by the RIS.	0-8 chars
Start_Delimiter	<	String used as start delimiter for the entries. If no delimiter is used by the RIS, an empty string must be entered.	0-8 chars
Stop_Delimiter	>	String used as end delimiter, see above.	0-8 chars
RIS_File_Char_Set	1	Character set used by the RIS to create the interface file: 0 = PC multilingual (850) 1 = ISO-IR 100 (Latin 1)	2 byte
Bidirectional	0	Bidirectional RIS interface (0=off, 1=on)	2 byte
RISsourcedOnly	1	Bidirectional RIS interface only for RIS sourced examinations (0=no, 1=yes)	2 byte

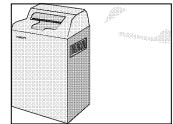
Table 3.2: RIS Configuration Defaults

1) depending on the use of a 2- or 4-digit year and the use of separators, three lengths of the format are possible:

- 6 characters, e.g.: ddmmyy
- 8 characters, e.g.: yyyyymmdd or dd.mm.yy
- 10 characters e.g.: dd.mm.yyyy

2) depending on the use of separators, two different lengths of the format are possible:

- 6 characters e.g.: hhmmss
- 8 characters e.g.: hh:mm:ss



3.2.1 Date and Time Conversion

The conversion of date and time entries must be done very flexibly because of the huge variety of formats. The date and time formats are defined in the RIS configuration. Both formats are defined using a string with identifiers for each date and time element such as dd or ss and optional separators. If no separators are used, the length of each element must be exactly equal to the defined length of the identifier. Leading blanks or 0 (ASCII 32₁₀ or ASCII 48₁₀) must be used to extend values of smaller length. If separators are used, the identifier gives the maximum length of a value. The separators are used to determine the currently used length.

Any single character that is not used as an identifier is allowed as a separator. It is recommended to use separators and to choose the separator from the set of characters of Table 3.3. For each of the date or time entries, only one separator character is possible. If "." (ASCII 46₁₀) is used for dates and ":" (ASCII 58₁₀) is used for times, they must be used for every date and time entry. If separators are used, they must be found at any possible location. Thus the date format strings "dd.mm-yyyy" and "dd.mm.yyyy" are **invalid**.

Type	Separators
Date	". " = ASCII 46 ₁₀ or "-" = ASCII 45 ₁₀ or "/" = ASCII 47 ₁₀
Time	". " = ASCII 46 ₁₀ or ":" = ASCII 58 ₁₀ or "-" = ASCII 45 ₁₀ or "/" = ASCII 47 ₁₀

Table 3.3: Recommended Date and Time Separators

The identifiers are defined in Table 3.4. A format must be used completely, which means that no identifier may be omitted. A correct date needs the day, month, and year, and a correct time needs hours, minutes, and seconds. If possible, the year should have a 4 digit length. If the value for a year is less than 100, by default, RSS adds 1900, which may lead to problems in the 21st century.

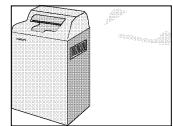
Type	Identifier	Description
Date	dd	two digit day
Date	mm	two digit month
Date	yyyy	four digit year
Date	yy	two digit year
Time	hh	two digit hour
Time	mm	two digit minute
Time	ss	two digit second

Table 3.4: Date and Time Identifier

A **time** always must be entered in **24 hour format**. There is **no AM/PM mode** supported by the RIS interface or the RSS program.

3.3 RIS-PCR User Terminal-Translation Table Configuration

Each element defined in Section 2.2.2: *RIS Input Interface Elements* or 2.2.3: *RIS Output Interface Elements* has a representation in this group of the configuration file. The key of an entry is the defined element name.



The value of an entry is the unique string the RIS uses as a keyword in the interface file. The **maximum length of a RIS keyword is 20 characters**. During the installation process, the service or application engineer adjusts the table configuration to the currently used RIS keywords, if they differ from the defaults. As defaults, the RSS descriptor element names are used (see Table 1 and Section 3.6: *Configuration File Example*). The RIS-PCR User Terminal-Translation Table consists of strings only. To change a RIS keyword, e.g. EXAM_TIME, the value of the [TABLE]-keyword Exam_Time must be modified (e.g. Exam_Time = TIME changes the RIS-keyword to TIME).

3.4 Unused Groups in the RIS-PCR User Terminal Configuration File

The RIS-PCR User Terminal Configuration file RIS_CFG.INI is used to handle all RIS related problems on a PCR User Terminal terminal. To avoid problems with different configuration files describing the same configuration, all RIS related configuration entries are put in the file RIS_CFG.INI. Entries belonging together are placed in a separate group. Groups not described in this document group do not belong to the PCR 5.3-RIS Interface and **must be left unchanged**.

3.5 RIS Input Interface Input and Output File Examples

Based on the default configuration which can be seen in Section 3.6: *Configuration File Example*, the following example RIS Input Interface file illustrates the results of this specification.

```
PATIENT_ID <12345678>
PATIENT_LAST_NAME <Doe>
ACCESSION_NUMBER <NONE>
PATIENT_BIRTHDAY <19611007>
PATIENT_GENDER <F>
PROCEDURE_CODE <PChest>
EXAM_TIME <123456>
EXAM_DATE <19960623>
PATIENT_FORE_NAME <John>
PATIENT_MIDDLE_NAME <Michael>
STUDY_UNIQUE_ID <NONE>
STUDY_LOCATION <R2 D2>
PATIENT_LOCATION <Q 423>
PHYSICIAN <Frankenstein^Victor^^Dr>
DIAGNOSIS <Appendicitis>
```

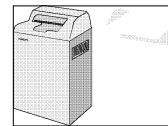
For the Procedure Code entry, a valid Procedure Code must be used. As an alternative to the last name plus optional first and middle name, the PATIENT_DICOM_NAME entry can be used, as in the following example:

```
PATIENT_DICOM_NAME <Doe^John^Michael>
```

Each part of the DICOM name must fit within the limits of last (24), first (19) and middle name (19).

An output file example based on the default configuration and containing only the twelve always sent elements plus the Procedure Code entry looks as follows under the assumption that PChest is defined as a Procedure Code scheduling Portable Chest views.

```
PATIENT_ID <12345678>
EXAM_TIME <123456>
EXAM_DATE <19970623>
FILM_LAYOUT <1on1-P-rot:P>
LAYOUT_POSITION <1>
FILM_COPIES <1>
EXAM_NAME <Portable Chest>
VIEW_NAME <AP Portrait>
RIS_SOURCED <1>
IMAGE_SEQUENCE <1>
DEFAULT_IMAGE_COUNT <1>
PROCEDURE_CODE <PChest>
```



3.6 Configuration File Example

The RSS configuration file `RIS_CFG.INI` is a binary file with a group substructure to be manipulated with the configuration tool `RIS_CFG`. The following example is an ASCII representation of this binary file using the standard values. The syntax is similar to the *MS Windows* INI-file syntax with group names in []-brackets and a "KEYWORD = VALUE" entry pattern. Unused groups are not mentioned here.

```
[RSS]
FileCheckInterval = 30
MaxErrorNum = 20
PatientDataExchange = 0
LoopTimeOut = 1
DebugMode = 0

[RIS]
Input_Path = c:\data\ris\input\
Output_Path = c:\data\ris\output\
Error_Path = c:\data\ris\error\
Date_Format = yyyyymmdd
Time_Format = hhmmss
RIS_Eof =
Start_Delimiter = <
Stop_Delimiter = >
Character_Set = 1
Bidirectional = 0
RIS_Sourced_Only = 1

[TABLE]
Patient_ID = PATIENT_ID
Patient_Last_Name = PATIENT_LAST_NAME
Patient_Fore_Name = PATIENT_FORE_NAME
Patient_Middle_Name = PATIENT_MIDDLE_NAME
Patient_DICOM_Name = PATIENT_DICOM_NAME
Accession_Number = ACCESSION_NUMBER
Study_Unique_ID = STUDY_UNIQUE_ID
Patient_Birthday = PATIENT_BIRTHDAY
Patient_Gender = PATIENT_GENDER
Exam_Time = EXAM_TIME
Exam_Date = EXAM_DATE
Study_Location = STUDY_LOCATION
Procedure_Code = PROCEDURE_CODE
Patient_Location = PATIENT_LOCATION
Physician = PHYSICIAN
Diagnosis = DIAGNOSIS
Exam_Name = EXAM_NAME
View_Name = VIEW_NAME
Film_Copies = FILM_COPIES
RIS_Sourced = RIS_SOURCED
Film_Layout = FILM_LAYOUT
Layout_Position = LAYOUT_POSITION
Image_Sequence = IMAGE_SEQUENCE
Default_Image_Count = DEFAULT_IMAGE_COUNT
```

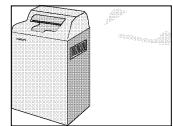
3.7 Configuration Tools

The PCR-RIS Interface can be configured completely using the configuration program `RIS_CFG`. The former configuration tools as `PROF_ED` for switching the interface mode and the character set are still provided with the product for compatibility. It is strongly recommended to use `RIS_CFG` for the RIS configuration file editing. The description of `RIS_CFG` can be found in Section 3.7.1, while the documentation of `PROF_ED` has been moved into Appendix A.

The scheduling of patients is done using *Procedure Codes*. These Procedure Codes must be defined in the PCR Procedure Code database which is a part of the PCR database. New Procedure Codes can be defined and existing codes modified using the option *Configure Procedure Codes* of the *Up-date/Reconfigure PCR*



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User Terminal menu, which calls the SAA_PROC program. The handling of SAA_PROC is described in Section 3.7.2.

The PCR 5.3-RIS Interface can run in two modes, the

- Schedule Mode (default), where at least one Procedure Code has to be found in an RIS Interface file and the
- Patient Data Exchange Mode, which allows, besides the scheduling, the addition of patients to the patient database of the PCR without any scheduling information.

The two programs SCHEDULE and EXCHANGE can be used as quick shortcuts to toggle between both modes (see Section 3.7.3).

The RIS Interface file is an ASCII file. The interpretation of ASCII files depends on the character set because only the first 128 characters are fixed. The interpretation of the second block of 128 characters depends on the character set. The RIS Interface program can interpret two different character sets

- PC multilingual (850) and
- ISO-IR 100 (Latin1) which is the default.

To switch quickly between them use the programs PC_MULTI and ISO_IR (see Section 3.7.4).

Changes of the configuration affect future RIS scheduling only. They do not change any already scheduled data. After a modification of the RIS_CFG.INI configuration, the PCR User Terminal must be restarted to activate the changes.

These tools can be used only from the *Service* screen, which requires a password. The Service screen can be started from the *Utilities* window. Except for SAA_PROC, these tools run only from the OS/2 *Command Shell* of the Service screen. To finally start the programs, select the Command shell, enter the program name, and hit the <Enter> key. To leave the command shell, enter the command EXIT and hit the <Enter> key. For the Procedure Code definition, select the *Update/Reconfigure PCR User Terminal menu* and start the item *Configure Procedure Codes*.

3.7.1 The RIS_CFG Program

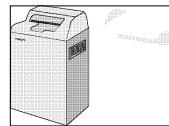
The keywords for the RIS Interface file, the formats, and the parameters can be modified easily using the RIS_CFG.CMD program. It is a REXX program using the IBM REXX interpreter of OS/2. To start the program, open an OS/2 Command Window from the Service screen, maximize its size, enter RIS_CFG and press the <Enter> key. After an initialization the main menu will appear on the screen

```
PCR 5.3 RIS Interface Configuration
Version 1.31
(c) 1997 Philips Medical Systems Hamburg Germany
```

```
(K)ewords or (F)ormats or (P)arameter or (H)elp or (Q)uit ? _
```

Enter the leading character of your choice and press <Enter> . (K)ewords , (F)ormats , and (P)arameter will lead to submenus that allows you to (V)iew or (C)onfigure the current keywords, formats, or parameters:

```
(V)iew or (C)onfigure or (M)ain menu ? _
```



To return to the main menu hit M for (M)ain menu. Whether you are in the keyword, format or parameter submenu is indicated by the word [KEYWORDS] , [FORMATS] , or [PARAMETER] in the line below the header. (V)iew clears the screen and displays the keyword or format names and its current values. The screen for the keywords looks like:

No.	Name	RIS Keyword	Page 1 of 2
1	- Patient_ID	= PATIENT_ID	
2	- Patient_DICOM_Name	= PATIENT_DICOM_NAME	
3	- Patient_Last_Name	= PATIENT_LAST_NAME	
4	- Patient_Fore_Name	= PATIENT_FORE_NAME	
5	- Patient_Middle_Name	= PATIENT_MIDDLE_NAME	
6	- Accession_Number	= ACCESSION_NUMBER	
7	- Study_Unique_ID	= STUDY_UNIQUE_ID	
8	- Patient_Birthday	= PATIENT_BIRTHDAY	
9	- Patient_Gender	= PATIENT_GENDER	
10	- Exam_Time	= EXAM_TIME	
11	- Exam_Date	= EXAM_DATE	
12	- Study_Location	= STUDY_LOCATION	
13	- Procedure_Code	= PROCEDURE_CODE	
14	- Patient_Location	= PATIENT_LOCATION	
15	- Physician	= PHYSICIAN	
16	- Diagnosis	= DIAGNOSIS	
17	- Exam_Name	= EXAM_NAME	
18	- View_Name	= VIEW_NAME	
19	- Film_Format	= FILM_FORMAT	
20	- Film-Copies	= FILM_COPIES	

Press any key to return to the main menu Page Down - next Page

After pressing the Page Down key the next screen displaying more keywords will be shown. Any other key will return you to the main menu. The second keyword screen looks like:

No.	Name	RIS Keyword	Page 2 of 2
21	- RIS_Sourced	= RIS_SOURCED	
22	- Layout_Position	= LAYOUT_POSITION	
23	- Image_Sequence	= IMAGE_SEQUENCE	
24	- Default_Image_Count	= DEFAULT_IMAGE_COUNT	

Press any key to return to the main menu Page Down - next Page

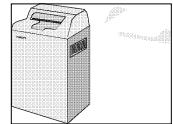
The formats screen will appear like:

No.	Name	RIS Format
1	- Input_Path	= c:\data\ris\input\
2	- Output_Path	= c:\data\ris\output\
3	- Error_Path	= c:\data\ris\error\
4	- Date_Format	= yyyymmdd
5	- Time_Format	= hhmmss
6	- RIS_EoF	=
7	- Start_Delimiter	= <
8	- Stop_Delimiter	= >
9	- RIS_File_Char_Set	= 1
10	- Bidirectional	= 0
11	- RIS_Sourced_only	= 1

The parameter screen will be displayed like:

No.	Name	RIS Parameter
1	- FileCheckInterval	= 30
2	- MaxErrorNum	= 20
3	- LoopTimeOut	= 1
4	- DebugMode	= 0
5	- PatientDataExchange	= 0

After pressing any character the main menu will be displayed.



The three (M)odify screens look like the (D)isplay screens but offer the additional lines

0 - Back to main menu
Enter your choice (1-20, 0): _

Page Down - next page

for the keywords first page. The valid numbers are shown in brackets. For the formats, this bracket entry looks like (1-10, 0): _ and for the parameter like (1-5, 0): _ . After entering a valid number and pressing <Enter> the framed edit field appears and you are asked for a new value, e.g.:

Enter new value for Exam_Time
EXAM_TIME_

An invalid number, an empty input or an input that is too long, is indicated by an error beep. You must enter valid values to leave these modes.

Every keyword value and most format values must be at least one character long. Only the RIS-End-of-File marker RIS_EoF and the two delimiters Start_Delimiter and Stop_Delimiter can be empty to define their absence. The Input_Path must always be terminated with a backslash.

A modification will be displayed immediately on the screen. After all your changes are done return to the main menu by entering 0 and <Enter>. Enter Q and <Enter> to quit the program. If you have made changes you will be asked

Save changes [Y/N] : _

Enter Y for Yes or N for No and hit <Enter>. If you enter N, all your changes will be discarded.

3.7.2 The SAA_PROC Program

The procedure codes of the PCR database can be modified using the SAA_PROC program. To start the program, enter the Service screen update option *Configure Procedure Codes*. This main menu will appear on the screen after up to 30 s as in the following example.

Procedure Code	Procedure Description
Enter #:	
A - Add, D - Delete, Q - Quit/Save	

A for Add: adds a new procedure code to the database

D for Delete: deletes an existing code

N for Next: toggle to next page if available

P for Previous: toggle to previous page if available

G for Goto: issues a number of an existing procedure code which is to be displayed (if more than one page exist)

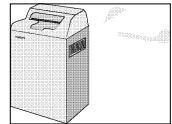
Entering the leading number (of a defined procedure code) allows the user to check or modify existing procedure code definitions. After installation, there are no Procedure Codes defined and the list is empty.

After pressing A for Add the following menu appears.

Configure a new Procedure Code
Enter new Codename:



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Enter the new procedure code name as it is used by the hospitals information system (HIS / RIS) with a maximum of 20 (DICOM: maximum of 16) alphanumeric and special characters and press <Enter>. Next a description of the code can be entered.

Configure a new Procedure Code

Enter new Codename: Test
Enter Description:

Enter the description of the procedure associated with this procedure code. (maximum 64 alphanumeric and special characters).

Configure a new Procedure Code

Enter new Codename: Test
Enter Description: my first procedure code

After having entered the description and pressed <Enter> you are automatically asked to select an exam. The screen will present a list of anatomical regions as predefined in the PCR database.

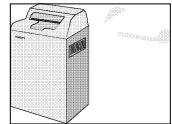
```
Procedure Code: Test
Select from Anatomy:
1 CHEST
2 SKULL
3 UPPER EXTREMITY
4 SPINE
5 ABDOMEN
6 LOWER EXT
7 SPECIAL
8 SERVICE

Enter #:
B - Back
```

Enter the number in front of an anatomical region name to select one (or B to return to the procedure code list) and hit <Enter>.



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Next the various examinations for an anatomical region must be selected. If your choice was 6 (LOWER EXT) this screen will look like

```
Procedure Code: Test
Select from Examination:
 1 - Pelvis                      20 - Ankle Tomogram
 2 - Ped Pelvis <3yr
 3 - Hip(s)
 4 - Ped Hip(s) <3yr
 5 - Femur
 6 - Knee
 7 - Patella
 8 - Tibia/Fibula
 9 - Ped Leg <3 yr
10 - Ankle
11 - Foot
12 - Ped Foot <3 yr
13 - Toes
14 - Hip Arthrogram
15 - Knee Arthrogram
16 - Ankle Arthro
17 - Venogram
18 - Knee Tomogram
19 - Hip Tomogram

Enter # :
B - Back
```

Return to the list of anatomical regions with B and <Enter>. Enter the number of the selected examination and press <Enter> to reach the final screen to configure the views for the examination. For the *Pelvis* examination (1) the possible views in the database are shown here.

```
Procedure Code: Test ,Exam: Pelvis
Select View Routine(*) / Non Routine:
 1 - AP                         (*)
 2 - Lateral
 3 - Soft Tissue
```

```
Enter # :
B - Back
```

A view of an examination is either

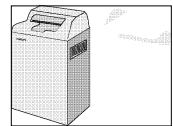
- Routine or
- Non-Routine.

If your procedure code definition should contain more or less routine views, toggle the selected view as routine or non-routine by entering the view number and <Enter>.

An exam must have at least one routine view and maximum 8 routine views.



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The Procedure Code definition of *routine* and *non-routine* views does not affect the regular selection of routine and non-routine views of manually scheduled examinations.

Finally, save the view list by entering B (Back) and <Enter>.

```
Procedure Code: Test ,Exam: Pelvis
Select View Routine(*) / Non Routine:
  1 - AP          (*)
  2 - Lateral
  3 - Soft Tissue

Save Routine views for procedure? Yes/No (Y/N):
B - Back
```

Enter Y for Yes and get a list of defined exams/views.

(Entering N for No: back without new exam)

```
Procedure Code "Test"
Description "my first procedure code"

  exam          view
  1 - Pelvis    AP
```

```
Enter # :
A - Add, D - Delete, R - Rename, B - Back
```

Add: Add new exams/views

Delete: Delete one view (you are asked for its number)

Rename: Rename procedure code name or description

Back: Back to procedure code list

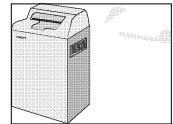
```
Procedure Code      Description
  1 - Test          - my first procedure code
```

```
Enter # :
A - Add, D - Delete, Q - Quit/Save
```

Only Procedure Codes defined using SAA_PROC can be used by the RIS to schedule by procedure code. Other procedure codes are ignored. If no valid procedure code is found in a RIS Interface file by the RIS Interface program either an error is reported or, if in Exchange-Patient-Data Mode (see Section 3.7.3: The SCHEUDLE and EXCHANGE Programs), only the patient demographic data is introduced into the PCR database.



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To quit the SAA_PROC program type Q and <Enter>.

Modification of Procedure Code Database finished.

S - Save Procedure Code Database
Q - Quit without saving Procedure Codes (all changes lost!)

Enter # :

Now type S for Save and then restart the USIT.

3.7.3 The SCHEDULE and EXCHANGE Programs

By default the PCR RIS Interface program is in Schedule Mode, which means that at least one valid procedure code must be found in a RIS Interface file. A hospital RIS always schedules a patient for certain examinations.

For a less powerful Hospital Information System (HIS) the *Patient Data Exchange Mode* is possible which also allows the introduction of patient demographic data into the PCR database without scheduling (see Section 2.2.5: *Patient Data Exchange Mode*), which must then be done on a PCR User Terminal. The regular scheduling by Procedure Code is still possible in this mode.

To switch the PCR RIS Interface program between modes, open an OS/2 Command Window from the Service screen first.

- Enter SCHEDULE and press <Enter> to switch the RIS Interface program to Schedule Mode. This is the default and is not necessary after installation.
- Enter EXCHANGE and press <Enter> to switch the RIS Interface program to Patient Data Exchange Mode. In this mode, scheduling is still possible, but in addition, if only patient demographic data is found in an RIS Interface file, these data is introduced into the PCR patient database.

3.7.4 The PC_MULTI and ISO_IR Programs

The default RIS Interface file character set is ISO-IR 100 (Latin1) but PC multilingual (850) can also be used. To switch the PCR RIS Interface program to interpret the RIS Interface file in a given character set, open an OS/2 Command Window from the Service screen first.

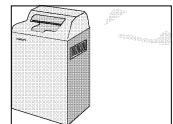
- Enter PC_MULTI and press <Enter> to switch on the character set for interpretation to PC multilingual (850).
- Enter ISO_IR and press <Enter> to switch on the default character set ISO-IR 100 (Latin 1).

3.7.5 The RIS_TEST Program

To simplify the RIS configuration the test program RIS_TEST.EXE has been developed. It is a service tool designed to find RIS related problems during the setup of the RIS interface. It reads a RIS input file and the current RIS configuration. A number of tests are performed to find potential problems and inconsistencies between the RIS configuration and the given RIS file. The program takes the name of a RIS file as parameter:



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Usage: RIS_TEST *filename*

Prior to using the program a RIS file must be transferred to the USIT PC. This can be accomplished by means of NFS or FTP. If the network connection has not yet been established, the file can be copied to the USIT PC via floppy disk. If the RIS file is not in the current directory, the full pathname of the RIS file has to be added to *filename*.

RIS_TEST will print an error or warning message for each known inconsistency that is found between the current configuration and the given RIS file. If no inconsistencies are found, it will display a message "No potential errors found."

RIS_TEST is distributed with USIT 1.4 and later versions.

3.8 OS/2 TCP/IP Configuration

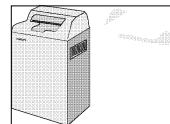
It is recommended to keep the RIS Output File directory on the PCR User Terminal PC. Only if this is not possible the RIS Output File directory must be mounted via NFS using TCP/IP. Besides these changes, the RSS configuration must be updated, too.

To run the OS/2 TCP/IP and NFS configuration program TCPCFG.EXE, open an OS/2 Command Window from the Service screen, enter TCPCFG <Enter> and use the Hot Keys from Table 3.5 to control it. Because of the screen resolution, not all configuration page tabs can be seen at once.

During runtime on the PCR User Terminal, the NFS drive Z: will be mounted, so only the drives G: to Y: are permitted to be used as network drives. Be sure not to change or corrupt the PCR User Terminal TCP/IP configuration. In addition, the PCR User Terminal uses IBM Peer for OS/2. If other peer services are to be added, be sure not to change the PCR peer configuration. For any changes, refer to the OS/2 documentation for further information about configuring the individual network environment.

Previous or next configuration program page	Alt-Page Up or Alt-Page Down
Next entry field, selection, box, or button	Tab
Make a selection or switch a check box	Space bar
Select next object	Cursor keys

Table 3.5: OS/2 Hot Keys



4. Error Handling

Usually, errors occur only during the adaptation to a specific RIS. This section lists all RSS errors with a brief explanation and describes the most relevant errors in more detail. In Table 4.1 all RSS errors are listed by their error numbers.

Code	Error Text	Description
23000	Configuration file ... is invalid; create default file	An old or corrupted configuration file will be replaced by a default file. All configuration changes must be done again.
23001	Default configuration file ... could not be created; use program defaults	The creation of the configuration file failed. Without this file, no changes to the default configuration can be made.
23002	Could not start interprocess communication.	If this error occurs only for the RSS program, install the correct version. Otherwise re-install the PCR User Terminal.
23003	Error in RIS file ...: mandatory element ... is missing or incorrect.	A mandatory element is missing or misspelled. An incorrect patient date of birth is also possible
23004	File ... cannot be scheduled.	General schedule error, retry.
23005	Length of entry ... in RIS file ... exceeded.	A certain RIS Interface file entry exceeds the maximum length for this entry (see Table 2.1: RIS PCR User Terminal Input Interface Elements)
23006	Could not delete RIS file	The RIS Interface File must be deleted by some other process.
23007	Could not initialize database access	Restart the PCR User Terminal. If the error arises again, reset the databases by copying the empty default files.
23008	Patient record in use.	Retry later.
23009	Patient name of file ... truncated.	A DICOM patient name was too long for the RIS entry fields. The name is truncated.
23010	RIS file ...: procedure code ... cannot be scheduled.	Usually the Procedure Code is wrong and does not match any of the procedure code database entries.
23011	RIS file ...: invalid character ... in Patient ID.	The PCR User Terminal Patient IDs are restricted to a-z A-Z 0-9 + - . / _ and accented characters.
23012	Could not move RIS file	The RIS interface file must be moved by some other process.

Table 4.1: RSS Error Messages

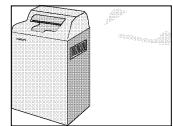
For real error messages the dots are replaced by strings.

During the adaptation, the most frequent error is 23003. This error indicates that a mandatory element was not found in the *RIS Interface File*. This can be caused by two reasons. Either this element is really missing or the keyword differs from the configuration. The missing keyword according to the configuration is displayed as a parameter in the error message. Because only mandatory elements can cause this error. When this problem occurs, it usually occurs with every *RIS Interface File*.

The service technician can find the rejected *RIS Interface File* in the error directory. He should compare the keywords with the configuration file. If the patient birthdate is marked as a missing or incorrect element (23003), a wrong date format or an impossible date such as May 33, 1997 can cause this error message. As in the PCR User Terminal, a birthdate must be more recent than January 1, 1801, which should be sufficient for any patient.

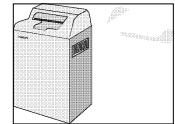


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If an error occurs for any mandatory field, or if the length of an entry exceeded its limit for any field (23005), the *RIS Interface File* will be ignored and moved to the error directory.

The number of errors placed in the error log is limited for each run of the PCR User Terminal software (default: 20). If more errors are expected during the RIS Interface test, this limit can be increased (configuration entry: [RSS] MaxErrorNum). Otherwise, the software must be restarted frequently to get information about the most recent errors.



A Appendix

The Appendix contains specifications of old parts of the PCR environment that are not necessarily supported in future version.

A.1 The PROF_ED Program

The configuration of the PCR programs is done using binary *.INI files in the OS/2 Profile Format. These binary files can be modified only by using special tools. PROF_ED is a general PROFILE Editor to modify binary *.INI files.

Start an OS/2 Command Window from the Service screen and maximize it. Use the CD command to change the current directory that the *.INI you want to modify is in the current directory. The PCR *.INI files are placed in the directory `c:\user\usit` by default. Except for the entering of new values, no additional hitting of the <Enter> is needed. PROF_ED reads the character directly from the input. The user must take care to press only the correct key. Unknown keys are ignored.

Enter

```
PROF_ED name.ini
```

and press <Enter> to start the program. `name.ini` is the name of the *.INI file to be modified. You will see the first screen

```
Profile editor Version 1.3.1 (c) Philips Medical Systems 1996
Caution: be careful using this tool!
You may damage your applications or OS/2 configuration!
An entry is updated immediately after your modification!
The order of the entries changes after an update!
Called with the only parameter <?>, </?> or </HELP> displays a help text.
Application groups in file RIS_CFG.INI: 4
Do you want to edit RIS_CFG.INI or create ASCII file PROF_ED.ASC (E/C/Q) ?
```

To get an overview of a certain *.INI file press C to create an ASCII file representation of the *.INI file. The name of the file will be PROF_ED.ASC. If you want another output file name, pass it as a second parameter in the program call as in

```
PROF_ED name.ini output.txt
```

The program will create the ASCII file and terminate. Use the EPM editor to inspect the ASCII file by entering

```
EPM output.txt
```

and pressing the <Enter> key.

An *.INI file is organized in groups which contain certain keywords and their current values. Once you decide which value to modify and what its group name is, you can enter the *edit mode* of PROF_ED by starting the program again and pressing E. Two more lines will appear as in

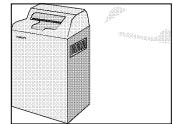
```
Keys in application group [TABLE]: 16
Do you want to change key entries of group [TABLE] (Y/N/Q) ?
```

PROF_ED is a simple program not designed for customers' use. It offers the possibility to step through the groups and its keywords for one pass. First find the correct group, then step through its keywords until you find the value to modify. Press Y if the group is correct, otherwise step to the next group by pressing N. Once you find the correct group, the next two lines are displayed:

```
entry <<Patient_ID>> = PATIENT_ID (max. 64 char.)
Do you want to change the value (Y/N/Q) ?
```



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PROF_ED knows parts of the structure of the RIS_CFG.INI file and a few other PCR *.INI files . If you use PROF_ED for another *.INI file or unknown entries it needs more information about the type of the values and the upper lines would look like:

```
entry <>Patient_ID>> = 1230258512
value may be text: PATIENT_ID
Do you want to change the value (Y/N/Q) ?
```

Press Y to enter the edit mode. This is dangerous because all changes are performed immediately. (To undo a change, restart PROF_ED, step to the new value and enter its old value.) The next line appears:

```
old value: PATIENT_ID, please enter new value:
```

If a configuration file is unknown to PROF_ED you are asked first for the type of the value which can be an (I)nteger number or plain (T)ext:

```
Is key value of integer or text type (I/T/Q) ?
```

Then the current value is displayed and you must enter the new one.

Hitting only the <Enter> key enters an empty value into the *.INI file. If you do not want to change the current value you must re-enter it.

PROF_ED can be quit at any time entering Q. It terminates automatically after displaying the last keyword of the last application group.